

CLAIMS

What is claimed is:

1. An inserting apparatus operable over a range of master cycle speeds comprising:
 - 5 (a) a master drive assembly operative over a master cycle and at variable master cycle speeds;
 - (b) an encoder operatively coupled to the master drive assembly and adapted to produce an encoder signal indicative of a current master cycle speed at which the master drive assembly is
10 operating;
 - (c) an insert conveyor assembly driven by a first motor at a variable insert conveyor speed;
 - (d) an envelope conveyor assembly driven by a second motor at a variable envelope conveyor speed;
 - 15 (e) a first actuator having a substantially constant activation time lag and disposed in actuating communication with a first peripheral device; and
 - (f) a motion controller for controlling the insert conveyor assembly speed, the envelope conveyor assembly speed and an activation
20 position of the first actuator based on the encoder signal, the motion controller electrically communicating with the encoder, the first motor, the second motor and the first actuator, wherein, at least once during every master cycle, the motion controller calculates the first actuator activation position and causes the first

actuator to be activated at the calculated first actuator activation position.

2. The apparatus according to claim 1 wherein the insert conveyor assembly
5 includes a plurality of insert pushing elements driven along a feed direction by the first motor.
3. The apparatus according to claim 2 wherein the envelope conveyor
assembly includes a plurality of envelope controlling elements driven
10 along the feed direction by the second motor.
4. The apparatus according to claim 1 wherein the envelope conveyor
assembly includes a plurality of envelope controlling elements driven
along a feed direction by the second motor.
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5. The apparatus according to claim 1 wherein, during any master cycle, the
insert conveyor assembly speed is greater than the envelope conveyor
assembly speed.
- 20 6. The apparatus according to claim 1 wherein the first peripheral device
includes an envelope opening mechanism.
7. The apparatus according to claim 6 comprising a second actuator having
a substantially constant activation time lag and a second peripheral
25 device disposed in actuating communication with the second actuator

wherein, at least once every master cycle, the motion controller calculates a second actuator activation position based on the encoder signal and activates the second actuator at the calculated second actuator activation position.

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8. The apparatus according to claim 7 wherein the second peripheral device includes an envelope registration mechanism.

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9. The apparatus according to claim 8 comprising a third actuator having a substantially constant activation time lag and a third peripheral device disposed in actuating communication with the third actuator wherein, at least once every master cycle, the motion controller calculates a third actuator activation position based on the encoder signal and activates the third actuator at the calculated third actuator activation position.

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10. The apparatus according to claim 9 wherein the third peripheral device includes a mail piece take-away mechanism.

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11. The apparatus according to claim 7 wherein the second peripheral device includes a mail piece take-away mechanism.

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12. The apparatus according to claim 11 comprising a third actuator having a substantially constant activation time lag and a third peripheral device disposed in actuating communication with the third actuator wherein, at least once every master cycle, the motion controller calculates a third

actuator activation position based on the encoder signal and activates the third actuator at the calculated third actuator activation position.

13. The apparatus according to claim 12 wherein the third peripheral device
5 includes an envelope registration mechanism.

14. The apparatus according to claim 1 wherein the first peripheral device includes an envelope registration mechanism.

10 15. The apparatus according to claim 1 wherein the first peripheral device includes a mail piece take-away mechanism.

16. An inserting apparatus operable over a range of master cycle speeds comprising:

- 15 (a) a master drive assembly operative over a master cycle and at variable master cycle speeds;
- (b) an encoder operatively coupled to the master drive assembly and adapted to produce an encoder signal indicative of a current master cycle speed at which the master drive assembly is
20 operating;
- (c) an insert conveyor assembly driven by a first motor at a variable insert conveyor speed;
- (d) an envelope conveyor assembly driven by a second motor at a variable envelope conveyor speed;

- (e) a first actuator having a substantially constant activation time lag and disposed in actuating communication with a first peripheral device; and
- (f) a motion controller for controlling the insert conveyor assembly speed, the envelope conveyor assembly speed and an activation position of the first actuator based on the encoder signal, the motion controller electrically communicating with the encoder, the first motor, the second motor and the first actuator; and
- (g) a computer program product comprising computer-executable instructions embodied in a computer-readable medium communicating with the motion controller, the computer program product adapted to, at least once during every master cycle, calculate the first actuator activation position and cause the first actuator to be activated at the calculated first actuator activation position.
17. The apparatus according to claim 16 wherein the insert conveyor assembly includes a plurality of insert pushing elements driven along a feed direction by the first motor.
18. The apparatus according to claim 17 wherein the envelope conveyor assembly includes a plurality of envelope controlling elements driven along the feed direction by the second motor.

19. The apparatus according to claim 16 wherein the envelope conveyor assembly includes a plurality of envelope controlling elements driven along a feed direction by the second motor.
- 5 20. The apparatus according to claim 16 wherein, during any master cycle, the insert conveyor assembly speed is greater than the envelope conveyor assembly speed.
21. The apparatus according to claim 16 wherein the first peripheral device
10 includes an envelope opening mechanism.
22. The apparatus according to claim 21 comprising a second actuator having a substantially constant activation time lag and a second peripheral device disposed in actuating communication with the second
15 actuator wherein, at least once every master cycle, the motion controller calculates a second actuator activation position based on the encoder signal and activates the second actuator at the calculated second actuator activation position.
- 20 23. The apparatus according to claim 22 wherein the second peripheral device includes an envelope registration mechanism.
24. The apparatus according to claim 23 comprising a third actuator having a substantially constant activation time lag and a third peripheral device
25 disposed in actuating communication with the third actuator wherein, at

least once every master cycle, the motion controller calculates a third actuator activation position based on the encoder signal and activates the third actuator at the calculated third actuator activation position.

5 25. The apparatus according to claim 24 wherein the third peripheral device includes a mail piece take-away mechanism.

26. The apparatus according to claim 22 wherein the second peripheral device includes a mail piece take-away mechanism.

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27. The apparatus according to claim 26 comprising a third actuator having a substantially constant activation time lag and a third peripheral device disposed in actuating communication with the third actuator wherein, at least once every master cycle, the motion controller calculates a third actuator activation position based on the encoder signal and activates the third actuator at the calculated third actuator activation position.

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28. The apparatus according to claim 27 wherein the third peripheral device includes an envelope registration mechanism.

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29. The apparatus according to claim 16 wherein the first peripheral device includes an envelope registration mechanism.

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30. The apparatus according to claim 16 wherein the first peripheral device includes a mail piece take-away mechanism.

31. A method for controlling an inserting apparatus over a range of master cycle speeds, the method comprising the steps of:
- (a) monitoring a master cycle speed at which an inserting apparatus operates over a plurality of master cycles;
 - 5 (b) determining when a new master cycle has begun;
 - (c) at least once during every master cycle of operation of the inserting apparatus, performing a first calculation to determine a first cyclical position of the new master cycle at which an actuated device should begin to be activated, wherein the calculation is
10 based on the master cycle speed measured for the new master cycle, a predetermined time duration required for the actuated device to become fully active, and a predetermined cyclical position of the new master cycle at which the actuated device should be fully active; and
 - 15 (d) at least once during every master cycle of operation of the inserting apparatus, causing the actuated device to begin to be activated when the new master cycle reaches or exceeds the calculated first cyclical position.
- 20 32. The method according to claim 31 comprising the steps of:
- (a) at least once during every master cycle of operation of the inserting apparatus, performing a second calculation to determine a second cyclical position of the new master cycle at which an actuated device should begin to be deactivated, wherein the
25 calculation is based on the master cycle speed measured for the

new master cycle, a predetermined time duration required for the actuated device to become inactive, and a predetermined cyclical position of the new master cycle at which the actuated device should be fully inactive; and

- 5 (b) at least once during every master cycle of operation of the inserting apparatus, causing the actuated device to become inactive when the new master cycle reaches or exceeds the calculated second cyclical position.

10 33. The method according to claim 31 wherein the step of causing the actuated device to begin to be activated includes energizing an envelope opening device.

15 34. The method according to claim 31 wherein the step of causing the actuated device to begin to be activated includes energizing an envelope registration device.

20 35. The method according to claim 31 wherein the step of causing the actuated device to begin to be activated includes energizing a mail piece take-away device.

36. A computer program product comprising computer-executable instructions embodied in a computer-readable medium, the computer program product adapted to perform the steps of:

- (a) monitoring a master cycle speed at which an inserting apparatus operates over a plurality of master cycles;
- (b) determining when a new master cycle has begun;
- (c) at least once during every master cycle of operation of the inserting apparatus, performing a first calculation to determine a first cyclical position of the new master cycle at which an actuated device should begin to be activated, wherein the calculation is based on the master cycle speed measured for the new master cycle, a predetermined time duration required for the actuated device to become fully active, and a predetermined cyclical position of the new master cycle at which the actuated device should be fully active; and
- (d) at least once during every master cycle of operation of the inserting apparatus, causing the actuated device to begin to be activated when the new master cycle reaches or exceeds the calculated first cyclical position.

37. The method according to claim 36 comprising the steps of:

- (a) at least once during every master cycle of operation of the inserting apparatus, performing a second calculation to determine a second cyclical position of the new master cycle at which an actuated device should begin to be deactivated, wherein the calculation is based on the master cycle speed measured for the new master cycle, a predetermined time duration required for the actuated device to become inactive, and a predetermined cyclical

position of the new master cycle at which the actuated device should be fully inactive; and

- (b) at least once during every master cycle of operation of the inserting apparatus, causing the actuated device to become inactive when the new master cycle reaches or exceeds the calculated second cyclical position.

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38. The method according to claim 37 wherein the step of causing the actuated device to begin to be activated includes energizing an envelope opening device.

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39. The method according to claim 36 wherein the step of causing the actuated device to begin to be activated includes energizing an envelope registration device.

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40. The method according to claim 36 wherein the step of causing the actuated device to begin to be activated includes energizing a mail piece take-away device.

- 20 41. A method for continuously inserting inserts into corresponding envelopes in a controlled manner over a range of master cycle speeds at which an inserting apparatus operates, the method comprising:

- (a) monitoring a master cycle speed at which an inserting apparatus operates over a plurality of master cycles;
- 25 (b) determining when a new master cycle has begun;

- 5 (c) at least once during every master cycle of operation of the inserting apparatus, performing a first calculation to determine a first cyclical position of the new master cycle at which an actuated device should begin to be activated, wherein the calculation is based on the master cycle speed measured for the new master cycle, a predetermined time duration required for the actuated device to become fully active, and a predetermined cyclical position of the new master cycle at which the actuated device should be fully active;
- 10 (d) at least once during every master cycle of operation of the inserting apparatus, causing the actuated device to begin to be activated when the new master cycle reaches or exceeds the calculated first cyclical position, wherein activation of the actuated device assists in an inserting process performed by the inserting apparatus;
- 15 (e) feeding an insert along a feed path at an insert feed rate in timed relation with the activation of the actuated device;
- (f) feeding an envelope along the feed path at an envelope feed rate in timed relation with the activation of the actuated device, wherein the insert feed rate is greater than the envelope feed rate; and
- 20 (g) causing the insert to be inserted into the envelope in timed relation with the activation of the actuated device.

42. The method according to claim 41 wherein the step of causing the actuated device to begin to be activated includes energizing an envelope opening device.
- 5 43. The method according to claim 41 wherein the step of causing the actuated device to begin to be activated includes energizing an envelope registration device.
- 10 44. The method according to claim 41 wherein the step of causing the actuated device to begin to be activated includes energizing a mail piece take-away device.